REMARKS

Claims 1-43 are currently pending in the present application and are presently under consideration. Claims 22,23, and 28-36 have been cancelled herein. However, applicants' representative reserves the right to pursue such cancelled claims in a continuation application at a later date. All pending claims with status identifiers are at pages 2-7.

Favorable reconsideration is requested in view of the comments below.

I. Rejection of Claims 1-12, 14-21, and 24-27 under 35 U.S.C. §103(a)

Claims 1-12, 14-21, and 24-27 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Dunphy, *et al.* (U.S. Patent 5,399,854) in view of Kersey, *et al.* (U.S. Patent 5,361,130) and Thomas, *et al.* (U.S. Patent 4,460,893). Reconsideration and allowance of claims 1-12, 14-21, and 24-27 is respectfully requested for at least the following reasons. Dunphy, *et al.*, Kersey, *et al.*, and Thomas, *et al.*, individually or in combination, do not teach or suggest all the claim limitations of the subject invention.

> To reject claims in an application under §103, an examiner must establish a *prima facie* case of obviousness. A *prima facie* case of obviousness is established by a showing of three basic criteria. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. *See* MPEP §706.02(j).

In particular, Dunphy, *et al.*, Kersey, *et al.*, and Thomas, *et al.* do not teach or suggest an ***optical fiber embedded in a bearing*** as recited in independent claims 1, 16, and 24. The present invention as recited in these claims employs ***an optical fiber embedded in a bearing*** to facilitate ***determining a state of at least one condition of the bearing.*** For example, the embedded optical fiber can be employed to determine wear of a babbitt within a bearing, state of lubrication, temperature within the bearing, *etc.* More

particularly, fringe patterns can be observed, and wear and rate of wear can be determined based at least in part upon alterations in the fringe patterns.

In contrast, Dunphy, *et al.* teaches an optical fiber that is not ***embedded*** within ***a bearing***. Rather, Dunphy, *et al.* embeds an optical fiber within a plurality of layers, wherein each of the layers includes graphite cylindrical reinforcing filaments that are arranged in a predetermined manner. *See* col. 4, lines 5-8. Utilizing this optical fiber and the filaments, Dunphy, *et al.* teaches that temperature and strain measurements can be obtained by employing a single Bragg grating. When the filaments are arranged in a particular manner, stress upon such filaments results in a strong differential strain that is imposed upon the optical fiber. The differential strain in turn induces birefringence in a portion of the fiber and grating that are embedded between the plurality of layers. *See* col. 5, lines 25-35. The induced birefringence also varies as a function of temperature. Thus, utilizing the teachings of Dunphy, *et al.*, an optical fiber can be employed to determine temperature and stress relating to a structure. Dunphy, *et al.*, however, does not teach or suggest ***embedding an optical fiber in a bearing*** as recited in the subject independent claims. The optical sensor of Dunphy, *et al.* requires patterned graphite cylindrical reinforcement filaments layered around an optical fiber to operate effectively. These reinforcement filaments are not existent within bearings, and placing a plurality of reinforcement filaments within a bearing would be impractical due to cost and design considerations.

Kersey, *et al.* teaches an optical system that senses changes in environmental conditions or physical phenomena. Kersey, *et al.* employs an optical fiber to provide broadband light to a sensor, which measures environmental conditions or physical phenomenon according to the received light wave. The sensor then relays sensed parameters in the form of a return light wave to a signal processor, which determines a measurement value based at least in part upon the returned light wave. Like Dunphy, *et al.*, Kersey, *et al.* fails to teach or suggest an ***optical fiber embedded in a bearing*** as recited in these claims.

The Examiner accordingly relies upon Thomas, *et al.*, to make up for the deficiencies of Dunphy, *et al.*, and Kersey, *et al.* Thomas, *et al.*, however, likewise does not teach or suggest ***providing a bearing having an optical fiber embedded therein*** as

recited in independent claim 24 (independent claims 1 and 16 include similar claim elements). Rather, Thomas, *et al.* teaches a system that detects wiping contact between a rotating shaft and bearing metal in a flow-lubricated bearing *via* monitoring temperature of the bearing where wiping contact will most likely occur. The bearing temperature is determined by providing a thermocouple that "is mounted in the bearing in close proximity to the maximum load-bearing point." *See* col. 3, lines 30-33. The Examiner states that "one of ordinary skill in the art would have replaced the sensor of Thomas with the fiber optic sensor of Dunphy...". As discussed *supra*, however, the fiber optic sensor of Dunphy, *et al.* requires graphite filaments surrounding an optical fiber to operate effectively, and creating bearings with such graphite filaments is implausible.

Furthermore, none of the cited references teach or suggest an ***end*** of an ***optical fiber... being flush with a contact surface of a bearing*** as recited in independent claim 16. The present invention as recited in this claim allows for a determination of wear on a bearing *via* positioning an optical fiber with an end ***being flush with a contact surface of the bearing***. By reflecting light from the contact surface, current wear and wear rate can be determined by, for example, monitoring fringe patterns. Thomas, *et al.* discloses a system that monitors temperature at a particular position of a bearing, and based upon such temperature determines whether wiping contact between a rotating shaft and bearing metal exists. Determining whether wiping contact exists between a shaft and bearing metal is quite different from monitoring wear and/or rate of wear within a bearing. Moreover, the thermocouple of Thomas, *et al.* is not shown to be ***flush with a contact surface*** as recited in independent claim 16, and no teaching or suggestion exists within the cited references to configure an ***optical fiber*** in such a manner. *See* Fig. 2, numeral 18.

In view of the foregoing, it is readily apparent that the rejection of independent claims 1, 16, and 24, and dependent claims 2-11, 17-21, and 25-26, which respectively depend therefrom, should be withdrawn.

II. Rejection of Claims 13, 27, and 37-43 under 35 U.S.C. §103(a)

Claims 13, 27, and 37-43 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Dunphy, *et al.* in view of Kersey, *et al.* and Thomas, *et al.* and further in view of Ide (US Patent 5,382,097). Reconsideration and allowance of claims 13, 27, and 37-43 is respectfully requested for at least the following reasons. Ide, like Dunphy, *et al.*, Kersey, *et al,* and Thomas, *et al.*, fails to teach or suggest ***an optical fiber imbedded in a bearing*** as recited in independent claims 1, 24, and 37. Accordingly, this rejection should be withdrawn.

III. Conclusion

The present application is believed to be condition for allowance in view of the above comments and amendments. A prompt action to such end is earnestly solicited.

In the event any fees are due in connection with this document, the Commissioner is authorized to charge those fees to Deposit Account No. 50-1063.

Should the Examiner believe a telephone interview would be helpful to expedite favorable prosecution, the Examiner is invited to contact applicant's undersigned representative at the telephone number listed below.

Respectfully submitted,
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